

A Connector

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The invention relates to a connector designed to prevent an intermediate portion of a retainer from warping.

DESCRIPTION OF THE RELATED ART

[0002] U.S. Patent No. 6,371,818 and FIGS. 10(A) to 10(C) show a connector with a retainer to prevent withdrawal of terminal fittings. With reference to FIGS. 10(A) to 10(C), the connector has a housing 1 with a bottom wall. A retainer insertion hole 2 is formed in the bottom wall for receiving a retainer 3 in a direction normal to an inserting direction of terminal fittings. This retainer 3 is held initially at a partial locking position where insertion of the terminal fittings into cavities 1a is possible. The retainer 3 then is pushed to a full locking position after the terminal fittings have been inserted. Thus, locking projections 3a of the retainer 3 engage the terminal fittings to prevent the withdrawal of the terminal fittings.

[0003] The retainer 3 is held at the full locking position by the engagement of end locks 3b of the retainer 3 with the opposite ends of the retainer insertion hole 2. However, the housing 1 has many cavities 1a arranged side by side in

widthwise direction, but only at a small number of stages. Thus, the retainer 3 is long and narrow, and a middle portion of the retainer 3 may warp away from the housing 1 at the full locking position due to an insufficient rigidity. Accordingly, a locking function for the terminal fittings may be insufficient. To offset this problem, intermediate locks 5 are set in an intermediate portion of the retainer 3 and intermediate receiving portions 1b are provided in the housing 1. As a result, the retainer 3 is prevented from warping away from the housing 1 at a middle position of the retainer 3. However, the intermediate locks 5 and the intermediate receiving portions 5 complicate efforts to provide a wide housing with cavities at narrow intervals.

[0004] The invention was developed in view of the above problems and an object is to provide a narrow, wide connector that prevents an intermediate portion of the retainer from warping.

SUMMARY OF THE INVENTION

[0005] The invention relates to a connector with a housing. Cavities are formed in the housing and are configured for accommodating terminal fittings. The cavities are arranged over a longer distance in widthwise direction than in height direction. A retainer mount hole is formed in the housing and communicates with the cavities. A retainer is movable in the retainer mount hole from a first position where insertion of the terminal fittings is permitted to a second position where the terminal fittings are locked. The retainer is locked at least at the second position by locking means at opposite side surfaces of the retainer and the retainer mount hole. A lock arm is provided on a surface of the housing to lock the connector to a mating connector. The cavities are arranged

at fewer stages in a forming area of the lock arm than in other neighboring areas. The retainer includes an intermediate portion substantially corresponding to the forming area of the lock arm. Additionally, partition walls overlap opposite side surfaces of a recess in the housing at the forming area of the lock arm when the retainer is at the second position. Engaging means are provided at the overlapping portions for locking the intermediate portion of the retainer.

[0006] The intermediate portion of the retainer is engageable with the recess of the housing. Thus, the retainer is locked securely at the second position and very little special space is required for locking in the widthwise and height directions. Accordingly, the retainer will not warp and the connector is made smaller.

[0007] The retainer preferably includes partition walls insertable to positions substantially between the respective cavities excluding an intermediate portion corresponding to the forming area of the lock arm.

[0008] The retainer mount hole preferably is in the bottom surface of the housing and extends in a widthwise direction.

[0009] The second position preferably is reached by inserting the retainer deeper in a mounting direction for holding the terminal fittings by locking sections on the retainer.

[0010] The lock arm preferably is at a widthwise middle on the upper surface of the housing, and the recess preferably is recessed from the upper surface of the housing toward the bottom surface of the housing.

[0011] The engaging means may include locking projections that project toward the opposite partition walls from the inner surfaces of the partition walls adjacent to the opposite sides of the intermediate portion and slits formed in opposite sides of the recessed portion. The locking projections engage resiliently with the slits when the retainer is at the second locking position. With this arrangement, the intermediate portion of the retainer is locked securely by resiliently engaging the locking projections with the slits and the engaging means has a simple construction.

[0012] The housing may have cavities at upper and lower stages, but only at one stage in the intermediate portion of the housing. The intermediate portion of the retainer has only a base plate, whereas side portions of the retainer define a lattice shape. Accordingly, the intermediate portion of the retainer is less rigid and more likely to warp. However, such warping is prevented by the engaging means in the intermediate portion to lock and fix the retainer.

[0013] The slits preferably are formed in substantially opposite side surfaces of the recess and correspond to the locking projections. The slits provide communication between the retainer mount hole and clearances between the lock arm and the side surfaces.

[0014] The retainer may have a plurality of partition walls coupled into a lattice shape by coupling plates at substantially opposite sides.

[0015] Most preferably, the retainer comprises locking means for locking the retainer in the first position.

[0016] These and other objects, features and advantages of the present invention will become more apparent upon reading of the following detailed

description of preferred embodiments and accompanying drawings. It should be understood that even though embodiments are separately described, single features thereof may be combined to additional embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a perspective view of a connector according to one preferred embodiment of the invention.

[0018] FIGS. 2(A) and 2(B) are a front view and a plan view of a housing.

[0019] FIG. 3 is a side view of the housing.

[0020] FIGS. 4(A) and 4(B) are sections along 4(A)-4(A) and 4(B)-4(B) of FIG. 2(A).

[0021] FIGS. 5(A) and 5(B) are a plan view and a front view of a retainer.

[0022] FIGS. 6(A) and 6(B) are a partial enlarged plan view and a partial enlarged front view showing an essential portion of the retainer, and FIG. 6(C) is a section along 6(C)-6(C) of FIG. 5(B).

[0023] FIGS. 7(A) and 7(B) are sections respectively showing the retainer at a partial locking position and at a full locking position.

[0024] FIG. 8 is a lateral section of a left half of the connector showing the state where the retainer is located at the partial locking position.

[0025] FIGS. 9(A) and 9(B) are partial enlarged sections showing an essential portion of an engaging means when the retainer is at the partial locking position and when the retainer is at the full locking position.

[0026] FIGS. 10(A) and 10(B) are a front view and a bottom view of a prior art connector and FIG. 10(C) is a front view of a retainer thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0027] A connector according to the invention is identified by the numeral 10 in FIG. 1. The connector 10 has a housing 11 made e.g. of a synthetic resin and terminal fittings T are inserted cavities 12 in the housing 11 (see FIGS. 7(A) and 7(B)). The housing 11 has width in a width direction WD much greater than its height along a height direction HD. The width preferably is more than four times, more preferably more than 7 times, most preferably more than 10 times the height. The cavities 12 are arranged e.g. in twenty three columns in the widthwise direction WD and at two stages in the height direction HD. The cavities 12 are formed only at the lower stage in the middle six columns and a lock arm 13 is formed at the upper surface. The lock arm 13 is cantilevered back from the front or mating end of the housing 11. Additionally, the lock arm 13 is resiliently deformable vertically towards and away from the housing 11. A locking claw 13a projects from the upper surface of the lock arm 13 and can engage lockingly with a mating connector. The upper surface of the lock arm 13 is substantially flush with the upper surface of the housing 11. Thus, a recess 14 is formed in the upper surface of the housing 11 in a forming area FA of the lock arm 13. The recess 14 defines a deformation area for the lock arm 13. The width of the recess 14 exactly corresponds to a sum of the widths of a plurality of columns, e.g. six columns, of the cavities 12, and clearances 14a are defined between side surfaces 14S of the recess 14 and the opposite side surfaces of the lock arm 13.

[0028] As shown in FIGS. 7(A) and 7(B), the cavities 12 penetrate the housing 11 in forward and backward longitudinal directions and the terminal

fittings T are insertable therein from behind along an insertion direction ID. A resiliently deformable lock 15 is provided at a middle of the bottom surface of each cavity 12 as shown in FIG. 4(A) for engaging the corresponding terminal fitting T.

[0029] A retainer mount hole 16 is formed in the bottom wall of the housing 11 over substantially the entire width, as shown in FIG. 2(B), and communicates with the cavities 12 as shown in FIGS. 4(A) and 4(B). A retainer 21 is mountable in the mount hole 16 in a mounting direction MD that is substantially normal to the inserting direction ID. The retainer mount hole 16 has a depth corresponding to the number of stages (e.g. one stage) for the (e.g. six) cavities 12 in the forming area FA of the lock arm 13. Engaging projections 17 project at each of the side walls of the housings 11 at opposite ends of the retainer mount hole 16, as shown in FIG. 3. The engaging projections 17 hold the retainer 21 at a partial locking position with a small insertion depth in the mounting direction MD and at a full locking position with a large insertion depth in the mounting direction MD.

[0030] The retainer 21 is made e.g. of a synthetic resin similar to the housing 11 and has a substantially flat base plate 22 with a width substantially corresponding to the width of the housing 11. Integral or unitary side plates 23 project vertically up at opposite lateral ends of the base plate 22. A locking recess 23a is formed in the inner surface of each side plate 23 for engaging the engaging portion 17 of the housing 11 at the partial locking position and the full locking position. A locking means is formed by the locking recesses 23a and

the engaging portions 17 (see FIG. 8) for locking and fixing the opposite lateral end surfaces of the retainer 21.

[0031] The retainer 21 has partition walls 25 that project vertically up from the base plate 22 substantially parallel to partition walls 12a between adjacent cavities 12 in the housing 11. The partition walls 25 are at both sides of the retainer 21, but are not in an intermediate portion 24 corresponding to the forming area FA of the lock arm 13. The partition walls 25 are insertable to positions adjacent the cavities 12 at the upper stage when the retainer 21 is mounted properly in the retainer mount hole 16. Upper ends of the partition walls 25 are joined by coupling plates 26 to define a lattice-shaped frame except in the intermediate portion 24. Projections 27 project from the upper surfaces of the base plate 22 and the coupling plates 26. The projections 27 are engageable with the rear ends of connecting portions Ta of the terminal fittings T that have been inserted to their proper positions in the cavities 12 to hold the terminal fittings T. The projections 27 have a projecting distance that permits the insertion of the terminal fittings T without interference at the partial locking position of the retainer 21. However, the projections 27 engage and lock the terminal fittings T when the retainer 21 is pushed to the full locking position (see FIGS. 7(A) and 7(B)).

[0032] The partition walls 25A adjacent the opposite sides of the intermediate portion 24 of the retainer 21 overlap opposite side surfaces 14S of the recess 14, when the retainer 21 is at the full locking position. Engaging means 28 are provided between the partition walls 25A and the opposite side surfaces 14S of the recess 14 for preventing the intermediate portion 24 from

warping. The engaging means 28 include substantially linear locking projections 28a (see FIGS. 6(A) and 6(B)) that face the inner surface of the opposite partition wall 25A and extending in an inserting direction ID of the terminal fittings T. The engaging means 28 also include slits 28b in opposite side surfaces 14S of the recess 14. The slits 28b communicate the retainer mount hole 16 and the clearances 14a (see FIGS. 9(A) and 9(B)). The intermediate portion 24 of the retainer 21 can be held lockingly by engagement of the slits 28b and the locking projections 28a.

[0033] The retainer 21 is pushed lightly in the mounting direction MD into the retainer mount hole 16 of the housing 11 (see FIG. 7(A)). Thus, the locking recesses 23a of the opposite side plates 23 of the retainer 21 engage the corresponding engaging projections 17 at the upper stage of the housing 11 (see FIG. 8). Accordingly, the retainer 21 is held at the partial locking position and projects slightly from the bottom surface of the housing 11.

[0034] The terminal fittings T then are inserted along the inserting direction ID into each cavity 12 of the housing 11 to a depth where the lock 15 engages the terminal fitting T. Thereafter, the retainer 21 is pushed in the mounting direction MD from the partial locking position to the full locking position (FIG. 7(B)). As a result, the locking recesses 23a of the retainer 21 engage the upper projections of the engaging portions 17 of the housing 11 and the locking projections 28a on the partition walls 25 at the opposite sides of the intermediate portion 24 engage the slits 28b in the recess 14 of the housing 11, as shown in FIG. 9(B). Accordingly, the retainer 21 is pushed evenly into the

retainer mount hole 16 over substantially the entire width, and the base plate 22 becomes substantially flush with the bottom surface of the housing 11.

[0035] The projections 27 of the retainer 21 correspond to the respective cavities 12 and engage the rear ends of the connecting portions Ta of the terminal fittings T. Thus, the terminal fittings T are locked by the retainer 21. The engaging portions 17 engage the locking recesses 23a to lock the opposite ends of the retainer 21 and the locking projections 28a engage the slits 28b to lock the intermediate portion 24 of the retainer 21. Thus, there is no likelihood that the secondary locking function of the intermediate portion 24 will fail due to the warping of the intermediate portion 24. The coupling plates 26 at opposite sides of the retainer 21 cooperate with the partition walls 25 to form a lattice shape that is difficult to deform. However, the intermediate portion 24 is substantially a single plate and is very likely to deform. Therefore, the above-described measure to prevent warping of the intermediate portion 24 is very important.

[0036] The engaging means 28 for preventing warping of the intermediate portion 24 include the locking projections 28a at the upper ends of the partition walls 25A and the slits 28b in the opposite side surfaces 14S of the recess 14. The recess 14 is the required forming area FA of the lock arm 13 on the upper surface of the housing 11. Thus, the engaging means 28 do not influence the intervals between the cavities 12 and there is no enlargement of the connector 10.

[0037] As is clear from the above description, the engaging means 28, 28a, 28b at the opposite side surfaces 14S of the recess 14 of the housing 11 and

the partition walls 25A adjacent opposite sides of the intermediate portion 24 of the retainer 21 engage each other. Thus, the narrow wide retainer 21 will not warp. Further, the engaging means 28, 28a, 28b are between the partition walls 25A and the recess 14 without additional members in the retainer 21 or the housing 11. Thus, the cavities 12 can be arranged at proper intervals without increasing the width of the connector 10, and the connector 10 is not enlarged.

[0038] Although the present invention is applied to the female connector 10 in the foregoing embodiment, it also can be applied to male connectors.

[0039] The locking projections 28a are in the retainer 21 and the slits 28b are in the housing 11 as the engaging means 28 for preventing the warping of the intermediate portion 24 of the retainer 21. However, the projections and the slits may be reversed or replaced by other projections and/or recesses.

[0040] Cavities 12 are arranged at two stages except in the intermediate portion of the housing 11 where the lock arm 13 is provided, and only one stage of cavities 12 is arranged at the intermediate portion of the housing 11 in the foregoing embodiment. However, the invention also is applicable to a connector with cavities at three or more stages provided that the intermediate portion 24 of the retainer 21 is likely to deform and warp.

[0041] Partition walls 25 substantially correspond to partition walls 12a between adjacent cavities 12. However, fewer partition walls 25 may be provided in the retainer 21 according to the invention, e.g. corresponding to each second partition wall 12a between adjacent cavities 12.